



# SERUM VITAMIN D LEVEL AMONG TYPE 2 DIABETES MELLITUS SUBJECTS IN MULLANA, HARYANA

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## ABSTRACT

Diabetes mellitus is a metabolic malady characterized by the presence of hyperglycemia due to defective insulin secretion, defective insulin action or both. India has over 60 million diabetics out of a population of 1.3 billion. Vitamin D refers to a group of fat-soluble secosteroids. Vitamin D deficiency is a significant public health problem. Numerous studies across various regions in India indicate that approximately 70-90% of apparently healthy population is vitamin D deficient. Studies have shown low vitamin D association with an increased risk of non-musculoskeletal diseases, such as type 2 diabetes mellitus since vitamin D deficiency is related to insulin secretion,  $\beta$ -cell dysfunction and insulin resistance.

**Materials and Methods:** The study was conducted in the Department of Biochemistry in collaboration of Department of Medicine, MM Institute of Medical Sciences and Research, Haryana. 100 T2DM diagnosed patients were taken. The concentration of serum 25OH vitamin D, was estimated by Chemiluminescence Immunoassay (CLIA) in two steps.

**Results:** Out of 100 T2DM patients 53 were males and 47 were females. The average serum vitamin D level among T2DM cases was  $19.09 \pm 5.34$  ng/ml. 10% of cases were highly vitamin D deficient and the remaining cases had insufficient vitamin D. Among insufficient vitamin D cases, about 29% had vitamin D level 10-19 ng/ml and about 71% had 20-29 vitamin D level. No cases had sufficient as well as possible toxicity amount of vitamin D level. It was found all T2DM patients were vitamin D deficient and insufficient independent of their gender and age group.

**KEYWORDS:** Type 2 Diabetes Mellitus, Vitamin D, Insulin Resistance,  $\beta$ -cell dysfunction.

## INTRODUCTION

Diabetes mellitus is a metabolic malady characterized by the presence of hyperglycemia due to defective insulin secretion, defective insulin action or both. India has over 60 million diabetics out of a population of 1.3 billion. The number of diabetics in the country is expected to increase to 109 million by 2035<sup>1</sup>. A combination of varying degrees of insulin resistance and relative insulin deficiency is likely that both contribute to type 2 diabetes. Vitamin D refers to a group of fat-soluble secosteroids responsible for enhancing intestinal absorption of calcium, iron, magnesium, phosphate and zinc<sup>2</sup>. The most important compounds in this group are vitamin D3 (cholecalciferol) and vitamin D2 (ergocalciferol). Vitamin D deficiency is a significant public health problem in both developed and developing countries including India<sup>3,6</sup>. Numerous studies across various regions in India indicate that approximately 70-90% of apparently healthy population is vitamin D deficient<sup>7</sup>. High prevalence has been attributed to a number of factors like poor sun exposure, skin complexion, vegetarian food habits & a lack of vitamin D fortification programme, older age and increasing pollution<sup>8</sup>.

Studies have shown low vitamin D association with an increased risk of non-musculoskeletal diseases, such as type 2 diabetes mellitus<sup>9,10</sup>. Although changes in lifestyle, particularly weight loss and physical activity, delay the progression of diabetes, weight loss is difficult to be achieved and maintained<sup>11,12</sup>. The identification of easily modifiable risk factors is therefore urgently needed for primary prevention of diabetes<sup>13</sup>.

Vitamin D deficiency is related to insulin secretion, insulin resistance and  $\beta$ -cell dysfunction in the pancreas<sup>14</sup>. Vitamin D has also been found to play role in peripheral insulin resistance. It has been reported that most patients with Type 2 diabetes mellitus (T2DM) have low vitamin D level. Accumulating the evidence from several studies, vitamin D is likely to have a role in T2DM. Vitamin D seems to affect glucose homeostasis, vitamin D levels having been found to be inversely related to glycosylated hemoglobin levels in diabetes mellitus<sup>15,16</sup>.

## MATERIALS AND METHODS

The study was conducted in the Department of Biochemistry in collaboration of Department of Medicine, MM Institute of Medical Sciences and Research, MM University, Ambala Haryana during the years 2014-2015. 100 T2DM diagnosed patients of either sex from age group 35 to 70 years attending OPD, were taken.

The study protocol was approved by Institutional Research Committee. The informed consent requirement for this study was exempted by the ethics committee. Venous blood was drawn. The concentration of serum 25OH vitamin D, total (25OH vitamin D2 and 25OH vitamin D3) was estimated by chemiluminescence (CLIA, Monobind USA) in a two-step procedure. The first step involved rapid extraction of vitamin D and second step involved competitive chemiluminescence immunoassay. Then statistical analysis of the result was done.

## RESULTS

Out of 100 T2DM patients (average age of  $57.54 \pm 9.00$  yrs.), 53 were males of average age  $58.43 \pm 8.96$  yrs. and 47 were females of average age  $56.4 \pm 8.99$  yrs. When cases were divided into different age groups, 39 cases were in 61-70 yrs. age group and only 6 cases were in <40 yrs. age group (Table 1).

**Table 1: Number of Cases Based on Age Interval**

Age Interval	No. of Cases
$\leq 40$	06
41-50	18
51-60	37
61-70	39

The average serum vitamin D level among T2DM cases was  $19.09 \pm 5.34$  ng/ml (Table 2) while vitamin D levels among male and female cases were  $19.06 \pm 6.13$  and  $19.15 \pm 4.35$  ng/ml (Table 3) respectively without statistically significant difference ( $p=0.937$ ; Table 3).

**Table 2: Biochemical Investigation Results of Cases**

	N	Mean	Std. Deviation
Duration of Diabetes (in Yrs.)	100	5.49	$\pm 5.68$
Vitamin D (ng/ml)		19.09	$\pm 5.34$

The highest level of vitamin D found among cases was 28.3 ng/ml and the lowest

level was found to be 5.5 ng/ml. These both levels were seen among the male cases. Among female cases, the highest and the lowest levels were 23.8 ng/ml and 9 ng/ml respectively.

**Table 3: Biochemical Investigations of Male and Females Cases**

	Males	Females	<i>p</i>
Duration of Diabetes	5.49±5.99	5.42±5.39	0.951
Vitamin D (ng/ml)	19.06±6.13	19.15±4.35	0.937

\*Significance at  $p < 0.01$

When the obtained values were classified according to the deficiency, insufficiency and sufficiency of vitamin D, 10 subjects (10%) of the cases were highly vitamin D deficient and the remaining cases had insufficient vitamin D. Among insufficient vitamin D cases, 26 (about 29%) had vitamin D level 10-19 ng/ml and 64 (about 71%) had 20-29 vitamin D level. No cases had sufficient as well as possible toxicity amount of vitamin D level (Table 4).

**Table 4: Vitamin D Status Among Cases**

	Number of Cases
Deficient: (<10 ng/ml)	10
Insufficient: (10-19 ng/ml)	26
(20-29 ng/ml)	64
Sufficient: (30-100 ng/ml)	Nil
Potential Toxicity: (>100 ng/ml)	Nil

Among various age group, most affected were <40 yrs. age group and then were 51-60 yrs. age group but there was not statistically significant difference in serum vitamin D levels among various age groups ( $p=0.809$ ; Table 5).

**Table 5: Biochemical Parameters Among Different Age Intervals of Cases**

	≤40	41-50	51-60	61-70	<i>p</i>
Duration of DM	5.37±4.05	4.11±5.66	5.52±5.23	6.03±6.14	0.701
Vitamin D (ng/ml)	17.35±8.13	19.83±4.61	19.04±5.20	19.1±5.11	0.809

\*Significance at  $p < 0.01$

## DISCUSSION

India is one of the epicenter of the global diabetes mellitus epidemic and has the second highest number of people with the disease in the world<sup>1</sup>. This high incidence is attributed to a combination of genetic susceptibility plus adoption of high calorie, low activity life style by India's growing middle class, population growth, aging and urbanization. Effective preventive means are therefore needed and modifiable risk factors should be identified and explored. Vitamin D insufficiency, which is highly prevalent might be such a factor. Interest in the role of vitamin D in T2DM risk has been emerging, although gaps still exist. In recent years, researchers have linked low vitamin D levels to insulin resistance and diabetes. Overcoming insulin resistance, in particular, could be a way to head off T2DM before it sets in. Indian population including all age groups are at the high risk of Vitamin D deficiency<sup>11</sup>. There is very little or no data from this part of the country regarding vitamin D and T2DM.

These results are very much competent with other studies conducted in different parts. A study by Bayani MA et al. among 120 diabetes cases and 120 healthy subjects showed vitamin D levels 18.7±10.2 ng/dl and 24.6±13.5 ng/dl ( $p=0.002$ ) among diabetes cases and healthy control respectively<sup>17</sup>. In the present study 10% of diabetes cases were vitamin D deficient and remaining were vitamin D insufficient; out of vitamin D insufficient cases, about 29% had vitamin D level 10-19 ng/ml. Bayani MA et al. findings suggest Vitamin D level was deficient in 64.2% patients, insufficient in 25% patients and sufficient in 10.3% patients<sup>17</sup>. Taheri E et al. demonstrated 85% of type 2 diabetics were suffering from vitamin D deficiency or insufficiency and vitamin D level was 22.08 ±15.20 ng/ml<sup>18</sup>. Mukherjee B et al.<sup>19</sup> from Odisha, Chaudhary S et al.<sup>20</sup> from Kolkata, Laway BA et al.<sup>21</sup> from Jammu and Kashmir, Siddiqui MH et al.<sup>22</sup> from Greater Noida and SV AK et al.<sup>23</sup> from Pondicherry have reported similar results as of the current study but Bajaj AH et al.<sup>24</sup> from Mumbai reported more number of vitamin D deficiency among non-diabetes than diabetes and more vitamin D sufficiency among diabetic patients. Diabetic patients had higher vitamin D level compared to non-diabetic subjects. Another study by Sheth JJ et al.<sup>25</sup> from Ahmedabad also reported vitamin D deficiency in 91.4% of T2DM cases. Many factors affect vitamin D, including variation by age, skin pigmentation, use of sunscreen, clothing and skin exposure, and season and latitude<sup>26</sup>. Older age is associated with a decreased synthesis of vitamin D and skin thickness decreases in humans linearly after the age of 20 years. High prevalence of vitamin D deficiency and insufficiency may be due to several factors like poor sun exposure, skin complexion, vegetarian food habits & a lack of vitamin D fortification programme, older age and increasing pollution<sup>5</sup>.

Although, the present study shows females with more vitamin D levels compared

to males among diabetes cases (Table 3) but the difference was not significant. Bayani MA et al. study showed females with higher vitamin D levels among diabetes cases with significant difference<sup>18</sup>. Kadi HA demonstrated serum vitamin D level among Saudi women to be 12.18 ±7.18 ng/ml which lower than the current study finding<sup>27</sup>. Although lower serum vitamin D levels among female diabetes could be explained as they lack physical activities and cover their most part of the body and apply sun screen when they go out but no studies found as such explaining lower or higher vitamin D levels among male and female diabetes cases. This could solely depend on geographical, socio-economic status and others. The most affected age group among T2DM cases in the present study was <40 years. They had vitamin D levels 17.35±8.13 ng/ml (Table 5). A research by Daga RA et al. showed vitamin D level of T2DM subjects of average age 16.9±0.71 years was 7.34±1.19 ng/ml<sup>28</sup>. This may be because young and working people have high mental pressure due to study and work load. They do not have proper healthy feeding habits, facing more pollution outside etc.

## CONCLUSION

It was found all T2DM patients were vitamin D deficient and insufficient independent of gender and age group. No date regarding vitamin D among T2DM cases have been reported from this region of the state prior this study. This study will help in prognosis of the disease because vitamin D supplementation has been shown to improve glucose tolerance among T2DM. This study will help to increase the awareness about importance of vitamin D among people. This study was totally hospital based only among 100 cases. More number of participants will give better outcome. Therefore, community based study is recommended for best outcome.

The authors declare no conflict of interest.

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